ALNOR®

CompuFlow®
ThermoAnemometer
model 8565

OWNER'S MANUAL

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SAFETY NOTICE

All necessary precautions must be observed when operating the CompuFlow ThermoAnemometer in the vicinity of moving equipment such as motors and blowers. The user must exercise care to ensure that the probe or the instrument does not interfere with any moving equipment.

WARNING

The operational range of the probe is 32 to 158 °F (−0 to 70 °C) and must not be exceeded. Calibration inaccuracies along with possible damage to the sensing element may result if the temperature range is exceeded.

The Thermo Anemometer is **NOT** designed for gas mixtures other than air. Use with corrosive or other dangerous gas mixtures is not recommended, and is at the user's risk.

Although the sensing element is protected, it can be damaged if subjected to abuse. It is not repairable.

BATTERY CAUTION

If the instrument is not to be used for more than two months, remove the batteries from the instrument and store them separately in a plastic container to avoid damage from possible leakage.

WARRANTY

Your warranty information and reply card are enclosed elsewhere in this package. After locating this material, please return the reply card and retain the remaining warranty information.

WARNING: Opening or otherwise attempting to service your Alnor instrument will void the warranty. Please read the warranty statement carefully.

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GENERAL DESCRIPTION

The CompuFlow Model 8565 ThermoAnemometer is a hand-held, battery operated, microprocessor based instrument capable of measuring either air velocity or temperature. This digital instrument measures velocities from 20 to 3000 FPM (0.1 to 15 m/s). Readings are displayed in 1 FPM increments between 20 and 700 FPM and in 10 FPM increments between 700 and 3000 FPM. The unique software program incorporated into this instrument allows it to accept up to 250 readings and display the average on demand. The ThermoAnemometer provides steady digital readings, as well as quick response, due to time-weighted averaging software with automatic override. When the parameter being measured changes radically with time or position, a HOLD feature freezes the display allowing the operator to concentrate on timing or probe positioning. The display can then be read afterward. Readings are available in both English and metric units with the push of a button. To allow for maximum long-term accuracy, this instrument is electronically calibrated, and can be easily recalibrated by Alnor or by your own calibration laboratory.

Three NiCd rechargeable batteries are used as the power supply and provide six hours of continuous operation after being fully charged. Recharge time is 12 to 14 hours.

For measuring air velocity or temperature in difficult locations the probe extends to 45" and can be used either as a straight wand or with the probe tip at 90° to the main probe body. This allows for traversing large ducts as well as clean benches and clean room ceilings (often without requiring a ladder).

The ThermoAnemometer kit comes in a convenient carrying case that is foam padded for maximum protection. The carrying case holds the meter, probe (either straight or at 90°) insulated duct sleeve, and battery charger. Additional compartments are available for optional accessories such as the Microprinter, printer paper, and extra batteries.

PREPARATION FOR USE

1. After carefully taking the instrument from the case, remove the protective cap from the tip of the probe. Carefully extend the probe to the desired length by pulling out the telescopic sections as shown in Figure 1. Do not place fingers inside the window of the protective tip. The sensor elements are located in this vicinity and must not be touched. Caution: To avoid damaging the probe, do not use excessive force when removing the protective cap from the tip.

2. The probe has been provided with a section that will rotate through 180° when a nut is loosened at the pivot point. Verify that the probe tip is at the desired angle (in line with, or at 90° to, the axis of the telescoping section) and that the air will flow into the side with the RED DOT. If the probe direction is to be changed, loosen the knurled retaining nut by turning counterclockwise (when viewing from the top). When pivot point is free rotate probe to desired position (straight or 90° in either direction) and tighten knurled nut. DO NOT OVER TIGHTEN, AND MAKE SURE THAT RED DOT WILL FACE AIR FLOW.

3. If the CompuFlow Microprinter is to be used, connect it to the CompuFlow ThermoAnemometer at this time. As shown in Figure 2, grasp the printer connector at the black collar and align the keyway. Gently push the connector forward about 1/4 inch. Lock the connector in place by rotating the silver collar clockwise about two full turns.

4. Check the charge on the batteries by switching the instrument to TEMPERATURE mode. For the first three seconds the display will show:
   0-indicates batteries should be recharged
   1-indicates at least one hour battery life

5. If the display is blank, the batteries are probably completely discharged. If a 0 appears, recharge the instrument for 12 to 14 hours before proceeding to take any extensive measurements. To charge the batteries, simply plug the charger into the instrument's charge connector as shown in Figure 3. The opposite end is connected into any 115V 50/60 Hz outlet. The instrument must be turned off to charge the batteries. A false reading on battery charge may result if the instrument is turned on during the charging operation. Once a 0 battery charge reading occurs, the instrument should be recharged for the full 12 to 14 hour period to ensure maximum battery life. If the battery charger is removed before the 12 to 14 hour recharge is complete, initial battery charge indication may be incorrect. If this is suspected, leave the instrument on for 60 seconds and then recheck battery life by turning the instrument off and then on to TEMPERATURE mode. Battery life indication should now be correct.

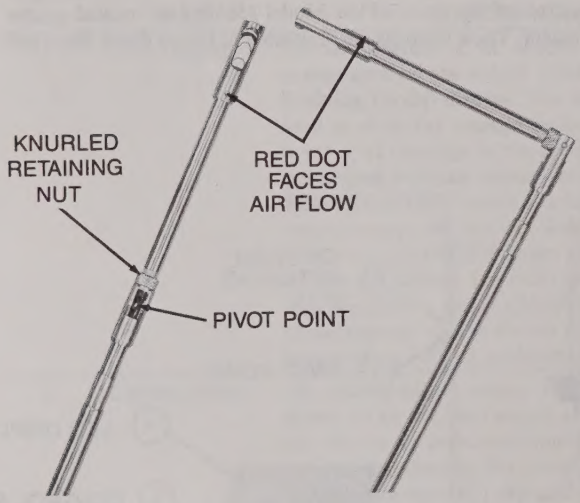


Figure 1. Telescopic Pivoting Probe

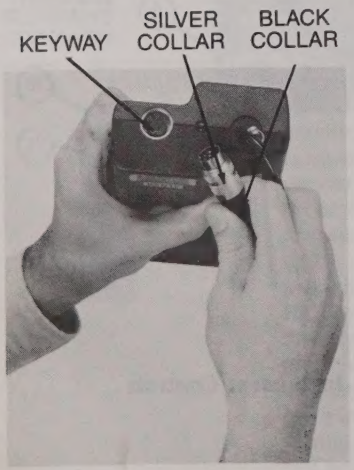


Figure 2. Printer Connector Insertion

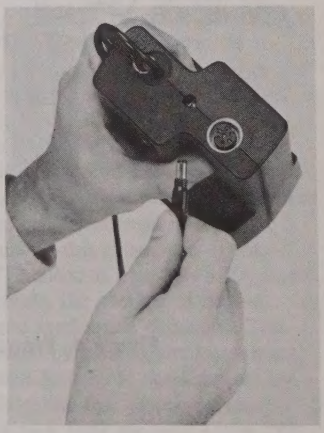


Figure 3. Battery Charger Insertion

OPERATION

The operating controls of the CompuFlow Model 8565 are all located on the front of the instrument. These controls are illustrated in Figure 4 and described in Table 1.

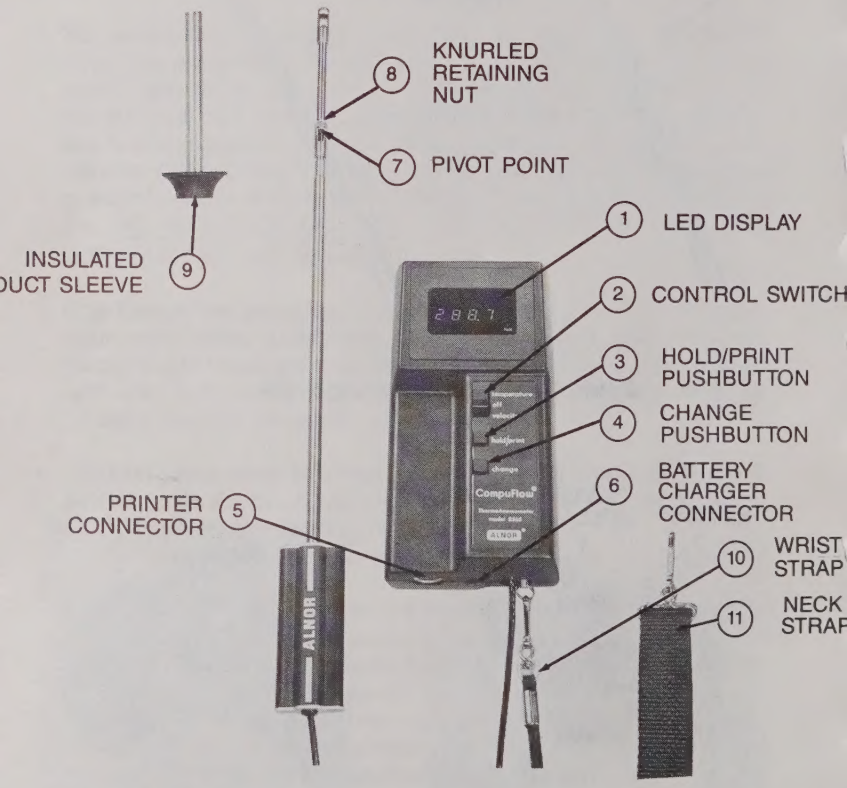


Figure 4. Front View Instrument Controls

Table 1. Instrument Controls Description

INDEX NO.	NAME	DESCRIPTION
1	LED Display	The temperature or air velocity reading is displayed on the 4-digit LED (Light Emitting Diode) display. This display is also used to show the average reading and the number of readings in the average. Initially, the display indicates battery condition when in TEMPERATURE mode. During temperature measurements, the display shows the units °F or °C. In VELOCITY mode, the units FPM or m/s are shown. The units are changed as described below under CHANGE pushbutton. Measurements can be frozen as described below under HOLD pushbutton.
2	Control Switch	The three position control switch turns the power on or off, and selects temperature or air velocity as the measurement parameter. In the middle position, the power is off and any information stored in the unit is lost. In the upper position, the instrument is in TEMPERATURE mode. A °F or °C will show on the display as verification of this condition. In the lower position, the instrument is in VELOCITY mode and the display will show either FPM or m/s. When switching between modes (Velocity and Temperature) switch unit OFF for at least 1 second before turning ON.
3	HOLD/PRINT Pushbutton	The HOLD/PRINT pushbutton can be pressed briefly to freeze the display. When the pushbutton is pressed again, the display will again show the value of temperature or velocity that is currently being measured by the probe. This action also enters the value previously frozen into the average memory. Up to 250 readings can be entered into the averaging circuit by this procedure. If the HOLD/PRINT button is held down for more than three seconds, the average of all the previously stored readings is displayed. The memory is cleared by turning the instrument off. (See Control Switch) If the CompuFlow Microprinter is connected, displayed values will be printed each time the HOLD/PRINT button is depressed to release the display.

Table 1. Instrument Controls Description (Cont.)

INDEX NO.	NAME	DESCRIPTION
4	CHANGE Pushbutton	The CHANGE pushbutton provides two different functions depending upon the prior operation of the instrument. UNITS CHANGE The CHANGE pushbutton can be pressed for about one second to change the unit of measurement from °F to °C while in TEMPERATURE mode. In VELOCITY mode, it will change the unit of measurement from FPM to m/s. Note that the alternate symbol does not come on until the pushbutton is released. The instrument can be changed between English and metric units at any time. AVERAGE COUNT If the CHANGE button is pressed when the HOLD LED is on, the number of readings taken will be displayed.
5	Printer Connector	A locking connector attaches the Microprinter to the meter.
6	Battery Charger Connector	The connector attaches the battery charger to the instrument. Charge the instrument only from the battery charger included with your unit.
7	Pivot Point	A Pivot Point allows three different positions for the probe tip. Make sure red dot faces air flow regardless of tip position.
8	Knurled Retaining Nut	Used to Lock pivoting probe into position. Do not over tighten.
9	Insulated Duct Sleeve	Used to protect probe elements when taking readings inside insulated ducts. Insert the sleeve into a 3/8 inch hole, and then insert probe through sleeve.
10 11	Wrist Strap Neck Strap	Attach either strap to ring at bottom of case with hook provided.

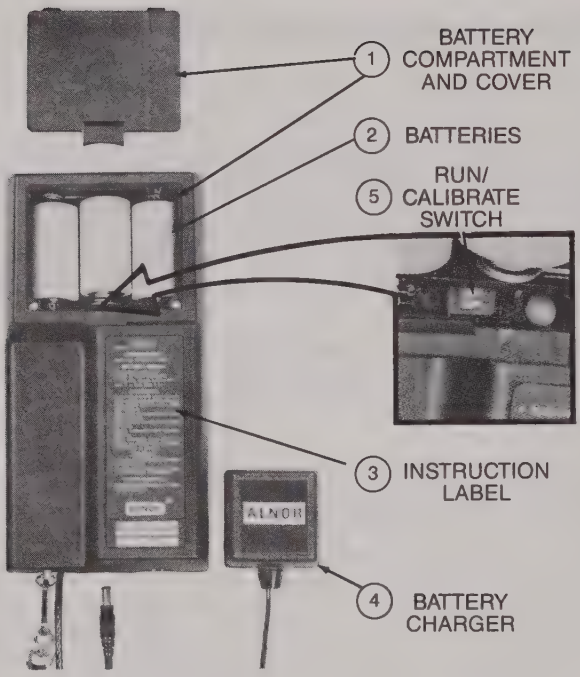


Figure 5. Rear View of the ThermoAnemometer

Table 2. Description of Features at Rear of Instrument

INDEX NO.	NAME	DESCRIPTION
1	Battery Compartment and Cover	The battery compartment located behind the display accommodates three NiCd batteries to power the instrument. The user should inspect the batteries at least every two months for leakage. To open the cover, push tab marked OPEN toward the top of the instrument, and then pull up.
2	Batteries	Three 1.2 volt NiCd rechargeable batteries supply the power to the instrument. C size heavy duty alkaline batteries may be used in an emergency, but battery life will be short. Do not use battery charger with alkaline batteries.
3	Instruction Label	A brief set of operating instructions is printed on the back label for quick reference.
4	Battery Charger	4.5 VDC, 180 mA charger.
5	RUN/ CALIBRATE Switch	The RUN/CALIBRATE switch is used to allow calibration of the instrument. Switch (both, if two are used) should be in the ON position during normal operation.

A. STEP BY STEP OPERATION-VELOCITY MEASUREMENT

1. Plug the CompuFlow Microprinter into the ThermoAnemometer (if desired).
2. Put the instrument into TEMPERATURE mode to check the battery voltage. Do this by depressing the control switch to the upper position. If the display shows a 1 for the first three seconds, proceed to step 3. If the display shows a 0, recharge the batteries before taking extensive measurements. A blank display likely means that the batteries are fully discharged. If this is the case, recharge the batteries for 12 to 14 hours.
3. Turn instrument OFF for at least 1 second, and then put it into VELOCITY mode by depressing the control switch to the lower position. The FPM LED will light and the instrument will drift to 0 FPM reading if the probe tip is covered.
4. If m/s rather than FPM are preferred, push the CHANGE button for approximately 1 second, and release. The LED indicator should change. If it does not change, repeat the process.
5. Take readings as required. Make sure that the air flow is coming towards the red dot on the tip of the telescopic probe. (NOTE: Use Part No. 534-493-127, insulated duct sleeve, when inserting probe through insulation.) Pivot section of the probe can be changed between straight and 90°, and made longer or shorter, without turning instrument OFF.
6. To freeze the reading on the display, push the HOLD button for about 1 second, and release. Caution: if button is held longer than 3 seconds the instrument will show the average (see step 9, below). To release the display, push the HOLD button a second time. (If the microprinter is attached, the value displayed will be printed.)
7. If the average of a number of readings will be required, turn the instrument off for at least 1 second and then back on before starting. This will clear its memory. Freeze each reading to be averaged as in step 6 above. When the display is released by pushing the HOLD button a second time, the number shown on the display is entered into the average.
8. To determine the number of readings in the average, hold the CHANGE button down while the HOLD LED is on.
9. To read out the final average, push the HOLD/PRINT button for at least 3 seconds (until the HOLD LED turns on). The number shown is the average. (If the Microprinter is attached the average will be printed.) To determine the number of readings in the average, push the CHANGE button down after the HOLD LED is on.

ONCE THE AVERAGE IS DISPLAYED, THE INSTRUMENT MUST BE TURNED OFF TO TAKE ADDITIONAL READINGS. THE MEMORY WILL BE LOST. INTERMEDIATE AVERAGES CANNOT BE SHOWN.

B. STEP BY STEP OPERATION—TEMPERATURE MEASUREMENT

1. Plug the Microprinter into the ThermoAnemometer (if desired).

2. Put the instrument into TEMPERATURE mode by depressing the control switch to the upper position. An indication of battery voltage will appear for the first three seconds. If the display shows a 1, proceed to step 3. Otherwise, recharge the batteries before taking extensive measurements.

3. If °C rather than °F are preferred, push the CHANGE button for approximately 1 second, and release. The LED indicator should change when the button is released. If it does not change, repeat the process.

4. Take readings as required.

5. To freeze the reading on the display, push the HOLD button for about 1 second, and release. Caution: if button is held longer than 3 seconds the instrument will show the average (see step 8, below). To release the display, push the HOLD button a second time. (If the Microprinter is attached, the value displayed will be printed.)

6. If the average of a number of readings will be required turn the instrument off for at least 1 second and then back on before starting. This will clear its memory. Freeze each reading to be averaged as in step 5 above. When the display is released by pushing the HOLD button a second time, the number shown on the display is entered into the average.

7. To determine the number of readings in the average, hold the CHANGE button down while the HOLD LED is on.

8. To read out the final average, push the HOLD button for at least 3 seconds (until the HOLD LED turns on). The number shown is the average. (If the Microprinter is attached, the average will be printed.) To determine the number of readings in the average, push the CHANGE button down after the HOLD LED is on.

ONCE THE AVERAGE IS DISPLAYED, THE INSTRUMENT MUST BE TURNED OFF TO TAKE ADDITIONAL READINGS. THE MEMORY WILL BE LOST. INTERMEDIATE AVERAGES CANNOT BE SHOWN.

PERFORMANCE CHECK

If a calibration check is made by the user, the following points should be considered. The probe is calibrated with the red dot facing the air flow (see Figure 1). If the flow is meeting the probe from the opposite direction, the stated accuracy may not be met. (NOTE: If probe has been inserted through insulation be sure the probe tip is clean.)

It is also important to remember that environmental conditions such as temperature, pressure, humidity and turbulence can have very different effects on the measuring result for different instrument types. These effects must be considered when comparing the CompuFlow ThermoAnemometer to other air velocity instruments.

Air velocity is rarely distributed evenly in a duct or in an open air stream. The velocity will generally be higher in the middle of the air stream than at the periphery due to either the friction at surfaces or to free standing air. This may cause discrepancies when comparing different instruments in the "same" air stream. The user should also realize that insertion of a probe in a channel of relatively small cross-sectional area changes the air velocity from the undisturbed case.

The user can check the calibration of the ThermoAnemometer against a Pitot static tube and inclined manometer. The ThermoAnemometer will have better resolution and generally be more accurate than a Pitot static probe and inclined manometer, especially for velocities below 600 FPM.

The instrument can be checked for zero conditions by covering the probe tip completely. If the display does not show 0 FPM, the instrument may be either out of calibration, or damaged. If the calibration is ever suspect, the probe tip should be cleaned as described in the MAINTENANCE section or the instrument should be recalibrated as described in the Calibration Procedure of this manual. If the instrument still seems to be out of calibration, contact your local Alnor distributor or Alnor Instrument Company.

If it becomes necessary to return the unit for repair, see the WARRANTY/ REPAIR INFORMATION AND INSTRUCTION FOR RETURN sections of this manual.

CALIBRATION PROCEDURE

GENERAL

The Model 8565 ThermoAnemometer incorporates a user-friendly calibration routine for both air velocity and temperature. These procedures should only be attempted by persons who have the proper equipment. Any attempt at recalibration voids all calibration certification provided with instrument.

NOTE: The calibration procedures of the 8565 features (Air velocity and temperature) are independent of each other. It is acceptable to calibrate one feature and not the other.

A. AIR VELOCITY CALIBRATION

Equipment Required:

This procedure requires the use of a note pad, a calculator, a small screw driver, and wind tunnel capable of generating wind velocities between 100-3000 FPM with variation of ±1% or less. Note: air density at which the calibration is done becomes reference air density in subsequent accuracy statements.

Preparation:

1. Check the charge on the batteries by switching the instrument on, in temperature mode. If in the first three seconds the display shows a zero or it is blank, refer to recharging procedure in Preparation For Use section before proceeding.
2. Probe must be clean prior to calibration. See the Maintenance section for proper cleaning procedure of the probe.
3. To access RUN/CALIBRATE switch open the battery compartment located behind the display. When turning instrument over make sure batteries are not dislodged.
4. Insert the probe into the tunnel. It is important that the probe is positioned where air speed is known precisely, and held firmly in tunnel with indicator mark toward the air flow.

Calibration:

1. Turn instrument off.
2. Move RUN/CALIBRATE switch to OFF (both switches if two available). See Figure 5 for location of switch.
3. Turn instrument on in velocity mode. This procedure displays the calibration constants S1, S2 and OFF3 one at a time. These calibration constants are represented by the status LEDs as °F, °C, and m/s respectively.

4. Record each constant that is displayed for °F(S1), °C(S2), m/s(OFF3) to document present calibration.

5. Turn instrument off.

6. Press and hold CHANGE button down.

7. Turn instrument on in velocity mode.

8. Continue to hold CHANGE button, until 0.80 °F appears on display, then release. This procedure puts the instrument in the programming mode. Note: It is important not to release CHANGE button until 0.80 °F appears on display to assure that instrument is set in programming mode.

9. Set S1 to 1.00 (reference value) by pressing the HOLD button down until reaching desired value and releasing it.

10. When instrument has stored data, 0.80 °C appears on display. Set S2 to 1.00 by pressing the HOLD button down until reaching desired value and releasing it.

11. When data has been stored, -280 m/s appears on display. Set OFF3 to 000 by pressing the HOLD button down until reaching desired value and releasing it. Disregard any decimals that appear in the display.

12. Turn instrument off.

13. Move RUN/CALIBRATE switch to ON (both switches if two available).

14. Turn instrument on in velocity mode.

15. Set tunnel air velocity to 600 FPM and record the reading displayed. Call this reading D1.

16. Set tunnel air velocity to 2400 FPM and record the reading displayed. Call this reading D2.

17. Using the following equation find the calibration factors:

    a. $S1 = \frac{600}{D1}$

    Expected range: $0.80 \leq S1 \leq 1.20$

    b. $S2 = \frac{2400 - 600}{D2 - D1} = \frac{1800}{D2 - D1}$

    Expected range: $0.80 \leq S2 \leq 1.20$

    c. $OFF3 = 700\ (S1 - S2)$

    Expected range: $-280 \leq OFF3 \leq 280$

    The results are to be used as the new calibration factors.

18. Turn instrument off.

19. Move RUN/CALIBRATE switch to OFF (both switches if two available).

20. Press and hold CHANGE button.

21. Turn instrument on in velocity mode.

22. Release CHANGE button. Instrument is now in programming mode.

23. 0.80° F appears on display. Set S1 to value calculated in step 17a as instructed in step 9.

24. When data is accepted, 0.80° C appears on display. Set S2 to value calculated in step 17b as instructed in step 10.

25. When data is accepted, -280 m/s appears on display. Set OFF3 to value calculated in step 17c as instructed in step 11. Note: Check for correct numbers as described in step 3. If in any case wrong values are programmed repeat steps 18-25.

26. Turn instrument off.

27. Move RUN/CALIBRATE switch to ON (both switches if two available).

28. Replace battery cover.

29. You have now calibrated your instrument. Record and date the new calibration constants.

30. Check calibration against standard as required.

---

*This two-point calibration procedure has been defined using 600 FPM and 2400 FPM. For other velocities, the equations in steps 17a, 17b and 17c can be expressed as

a. $S1 = \frac{V_A}{D_A}$

b. $S2 = \frac{V_B - V_A}{D_B - D_A}$

c. $OFF3 = 700(S1 - S2)$

Where

V_A = Tunnel Air Velocity, $400_A \leq V_A \leq 650$

D_A = 8565 Reading at V_A

V_B = Tunnel Air Velocity $1000 \leq V_B \leq 3000$

D_B = 8565 Reading at V_B

B. TEMPERATURE CALIBRATION

Equipment Required:

An ice bath composed of crushed ice and water, both deionized.

WARNING

The instrument will assume that the temperature of the ice bath is exactly 0 °C (32 °F), and will calculate the necessary factors so that 0 °C (32 °F) is stored and displayed. Any variation in this ice bath temperature from 0 °C will result in a corresponding inaccuracy in all temperature readings displayed by the instrument after calibration.

Preparation:

1. Check the charge on the batteries by turning the instrument on in temperature mode. If in the first three seconds the display shows a zero or it is blank refer to recharging procedure before proceeding.
2. Probe tip must be clean prior to calibration. See the Maintenance section for proper cleaning procedure of the probe.
3. To access RUN/CALIBRATE switch open the battery compartment located behind the display. When turning instrument over make sure batteries are not dislodged.
4. Insert probe into ice bath and let soak for at least 5 minutes. Be sure that the reading has stabilized (no more than ± 1 digit movement) before continuing.

Calibration:

1. Turn instrument off.
2. Move RUN/CALIBRATE switch to OFF (both switches if two available). See Figure 5 for location of switch.
3. Turn instrument on in temperature mode. 00.00 °F will appear on diplay.
4. Press and release CHANGE button.
5. 00.01 °F appears on display (meaning calibration in process).
6. Allow 10 secs to complete process. When the process is completed either 00.02 °F or 00.05 °F appear on display. The 00.02 °F informs the user that calibration is complete. The 00.05 °F indicates that the temperature read by the instrument is different than the original factory calibration by more than 5 °F, and the calibration procedure was aborted. In the case of a calibration failure make sure that ice bath is at the specified temperature, the probe is properly submerged, and repeat this process.

7. Turn instrument off.
8. Move RUN/CALIBRATE switch to ON (both switches if two available).
9. Replace battery cover.
10. Check calibration against standard as required.

MAINTENANCE

The probe tip should be cleaned occasionally by immersing it briefly in denatured or in isopropyl alcohol, and drying it in a gentle stream of air. If moisture appears on the probe, allow it to dry thoroughly before use. Do NOT apply direct heat. If probe has been inserted through insulation, use of spray cleaner (see List of Models and Parts) may produce better cleaning.

The outside carrying case can be wiped clean using a damp cloth and a mild detergent. Do not allow liquids to get inside the instrument.

The batteries should be examined at least every two months for signs of corrosion. To open the battery cover, push the tab marked OPEN toward the top of the instrument and then pull up. Remove the batteries if there is corrosion on the ends of the batteries, or in the compartment. Clean the affected parts with a clean cloth moistened with water only. Allow all parts to dry thoroughly and reinstall the batteries. The instrument should be stored with the batteries fully charged. However, if the instrument is not to be used for more than two months, remove the batteries and store them separately in a plastic container to avoid damage from possible leakage.

NOTE: When installing batteries, observe the polarity markings shown on the bottom of the battery compartment.

If the battery life consistently falls short of 6 hours, the batteries may have to be exercised by fully discharging them. The batteries can then be recharged over a period of 12 to 14 hours. (Use only the battery charger which is specified for use with this instrument for charging the batteries.) This process of full discharge and recharge may have to be repeated two or three times.

DO NOT OVER-DISCHARGE; BATTERY DAMAGE MAY RESULT.

Full discharge can be detected when battery voltage is too low for proper operation. Discharging batteries by leaving the instrument on while unattended for long periods, such as overnight, is NOT recommended.

If battery life does not return to a minimum of 6 hours after following this procedure, the batteries should be replaced.

NOTE: Except for the batteries, there are no user maintainable parts inside the unit.

LIST OF MODELS AND PARTS

MODEL NO.	PART NO.	KIT DESCRIPTION
8565	634-493-400	CompuFlow ThermoAnemometer with telescopic probe, battery charger case
8520	638-493-000	CompuFlow Microprinter
	639-000-000	CompuFlow R5232 Interface Module, with demonstration software

PARTS LIST

534-493-147	Carrying Case
459-009-004	Battery Charger
116-159-013	Instruction Manual 8565
459-000-002	NiCd 1.2V C-size battery
534-493-127	Insulated duct sleeve

LOCALLY AVAILABLE ITEMS

Radio Shack (Archer) Cat. No. 64-2322	Cleaner/degreaser

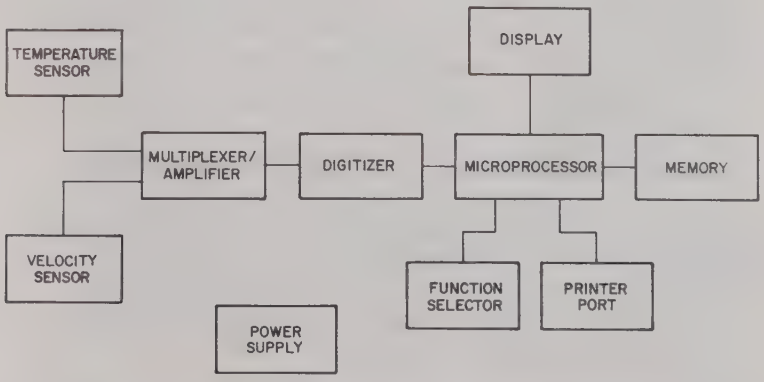


Fig. 6. Key Components of the ThermoAnemometer

THEORY OF OPERATION

General
The model 8565 ThermoAnemometer can be divided into the main function parts shown in Figure 6. Each performs a key role in the operation of the instrument. All functional components except sensors are mounted on two printed wiring boards located within the instrument housing.

Temperature Sensor
The temperature sensor is made of fine nickel wire, which changes resistance with temperature. This sensor is located in the lower half of the probe tip.

Velocity Sensor
The velocity sensor is fine nickel wire heated with a constant current flow. Air passing over this sensor will result in a cooling of the sensor and a change in its resistance. This sensor is located in the upper half of the probe tip.

Multiplexer and Amplifier
Under the control of the microprocessor, the multiplexer connects one of several inputs (temperature sensor, velocity sensor, battery voltage, etc.) through the amplifier to the digitizer.

Digitizer
The digitizer converts the input signal to numeric data which is usable by the microprocessor in mathematical calculations.

Microprocessor
The microprocessor analyzes data obtained from the sensors and related signals, converting them to data useful to the user.

Memory
Instructions for the operation used by the microprocessor and linearization data are stored in permanent memory. Calibration constants are stored in memory which can be changed as required.

Display
The display converts signals from the microprocessor to characters readable by the user. In addition to the measurement value, the display indicates units in use, over-range conditions, etc..

Function Selector
The function selector consists of the TEMP/OFF/VELOCITY, HOLD/PRINT, and CHANGE switches, as well as the concealed RUN/CALIBRATE switch. These switches transmit user instructions to the microprocessor.

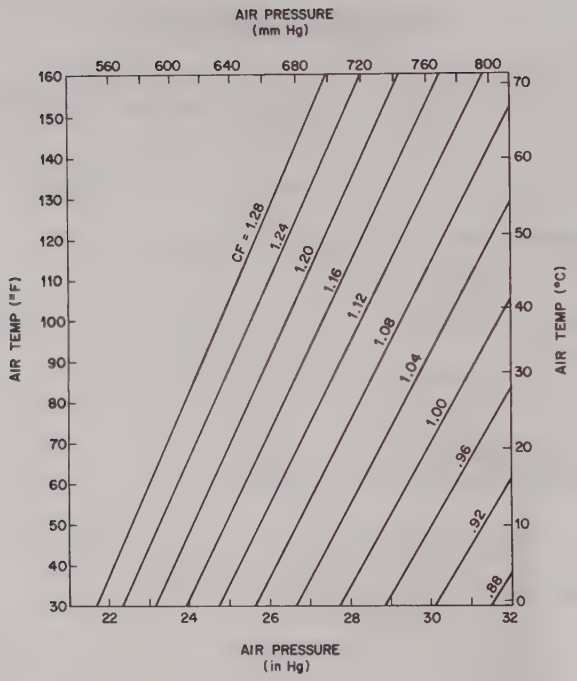
Printer Port
The printer port provides the necessary signals and connections to drive either a CompuFlow MicroPrinter, or CompuFlow Interface Module. The connection is made through a keyed connector at the base of the instrument.

Power Supply
The power supply converts energy supply by the rechargeable NiCd batteries into voltages required by the various internal components.

TROUBLESHOOTING GUIDE

A guide to the elimination of minor problems is provided in the table below.

SYMPTOM	POSSIBLE CAUSES AND CORRECTIVE ACTIONS
No display	Switch is not fully on. Batteries are fully discharged. Recharge batteries.
Display is dim	Batteries are low. Recharge the batteries.
Display is erratic	RUN/CALIBRATE switch off. Turn switch on (both switches if two available).
Measurement is erratic	Probe is not being held steady. Flow field is unstable or very turbulent.
Erroneous readings	Probe sensing element is dirty. Clean probe tip. Measurement method is incorrect. See PERFORMANCE CHECK section.
Batteries do not last 6 hours	Cycle batteries from complete discharge to full charge two or three times. See MAINTENANCE section. Batteries are old. Replace batteries.
Printer does not print	Printer was plugged in after instrument was turned on. See Microprinter manual.
Display shows 9999 or 99.99	Air flow is beyond the range of the instrument. Reduce air flow.



NOTES:

1 (in. H_2O) X 7.36(10^{-2}) = 1 in. Hg

$$CF = \frac{.075 \times (459.7 + \text{TEMP}(°F))}{1.325 \times \text{AIR PRESSURE (in. Hg)}}$$

Figure 7. Correction Factors for Non-Standard Conditions

DENSITY CORRECTION FACTORS

The velocity reading of ALNOR ThermoAnemometers are referenced to standard condition, 70°F and 29.98 in. Hg (20°C and 1015 mbar). Therefore they directly measure the mass velocity of the air. In order to obtain the actual velocity a density correction should be used as follows:

$$V_a = V_i \times d_s/d_a \qquad d_s/d_a = CF$$

Where d_s = air density at standard calibration conditions of .075 lb/cu ft or 1.20 Kg/cubic meter

d_a = actual air density at local temperature and barometric pressure

V_a = actual air velocity

V_i = indicated velocity on the Alnor ThermoAnemometer

SPECIFICATIONS

INSTRUMENT DISPLAY	4-digit, 5/16" high LED's. Separate indication for FPM, m/s, °F, °C and HOLD
AIR VELOCITY RANGE	20 to 3000 FPM (0.1 to 15 m/s)
INSTRUMENT TEMP MEASURING RANGE	32 to 158°F (0 to 70°C)
OPERATIONAL RANGE	
Instrument:	32 to 122°F (0 to 50°C)
Probe:	32 to 158°F (0 to 70°C)

ACCURACY

Air velocity † (Air Temp. 75-79°F, 24-26°C):

20-100 FPM	± 5 FPM (± .03 m/s)
100-600 FPM	± 3% of reading ± 2 FPM (± .01 m/s)
600-3000 FPM	± 3% of reading ± 20 FPM) (± 0.1 m/s)

Temperature: ± 0.8°F (± 0.4°C)

Temperature Drift †: ± 1/4% of reading or 1/4 FPM (whichever is greater) for each °C change in Air Temperature

RESOLUTION

Air Velocity:	1 FPM from 20 to 700 FPM (.01 m/s from .1 to 3.55 m/s) 10 FPM from 700 to 3000 FPM (.1 m/s from 3.55 m/s to 15 m/s)
Temperature:	0.1°

† These specifications are valid only if measurements are taken in a 4" dia. or larger duct or free air, the temperature gradient across the duct is less than 0.1°C, and the turbulence level is less than 1.5%.

SPECIFICATIONS

BATTERIES	Three 1.2V C-size rechargeable 2200 mAH NiCd cells
BATTERY RECHARGE TIME	12 to 14 hours
BATTERY LIFE	Minimum 6 hours continuous service (without printer in use)
INSTRUMENT DIMENSIONS	2 3/4″x4″x7 1/2″ (70x102x190 mm)
INSTRUMENT WEIGHT WITHOUT PROBE	1 lb. 7 oz. (651 grams) with batteries
CARRYING CASE	Black plastic, foam padded; 17 1/4″x4 5/8″x14″ (430x117x356 mm), with handle
TELESCOPIC PROBE	.355″ (9 mm) max diameter Handle 3 1/2″ long x 1 1/2″ wide Length 20″ closed, extendible to 45″. (508 mm extendible to 1143 mm) Flexible cable 7 ft. (2.1 M) long Pivoting section 4.5″ (114 mm) long at tip end, lockable in straight or either 90° position. Flex life: 2000 cycles minimum.
PRINTER PORT	For use with ALNOR CompuFlow Microprinter P/N 638-493-000 or CompuFlow RS232 interface module P/N 639-000-000
FIELD CALIBRATION ADJUSTMENT RANGE	± 20% change from factory calibration.

Specifications subject to change without notice.

PRACTICAL APPLICATIONS

AIR VOLUMES AT SUPPLY OPENINGS

When determining the volume output of an opening having no grille, use the following equation:

$$Q = A\ V$$

where

Q = flow rate in cubic ft/min or cubic meters/sec
A = area in square feet or square meters
V = average velocity in ft/min or meters/sec

If the opening is covered by a grille, divide the opening into a number of equal areas. Measure the velocity at the center of each area. Generally 6 to 20 measurements will be adequate. It is suggested that the probe be held about 1 inch downstream from the grille. The average velocity of all areas will then be "V" in the above equation. "A" will be the core area.

VELOCITIES INSIDE DUCTS

To measure velocities inside ducts, it is necessary to have an opening in the duct wall. In case there is no opening provided, a hole 3/8 inch in diameter must be drilled for insertion of the probe. (NOTE: Use Part No. 534-493-127 insulating duct sleeve when inserting through insulation, to avoid sensor contamination.)

Since air velocities are rarely uniform within the entire cross sectional area of duct, it is necessary to determine the average velocity. In general, the greater the number of readings taken to obtain the average, the higher the accuracy.

Select a straight section of duct, at least 10 duct diameters downstream from the nearest turn, transformation, damper or other source turbulence.

AIR VOLUME INSIDE A DUCT

To determine the air volume passing through a duct, it is necessary to calculate the average velocity inside the duct. The cross sectional area of the duct must also be calculated. Air volume can then be determined from the following equation:

$$Q = A\ V$$

where

Q = volume of air in cubic ft/min or cubic meters/sec
A = Cross sectional area in square ft or square meters
V = Average velocity in ft/min or meters/sec

To calculate the average velocity within a duct, several methods can be used.

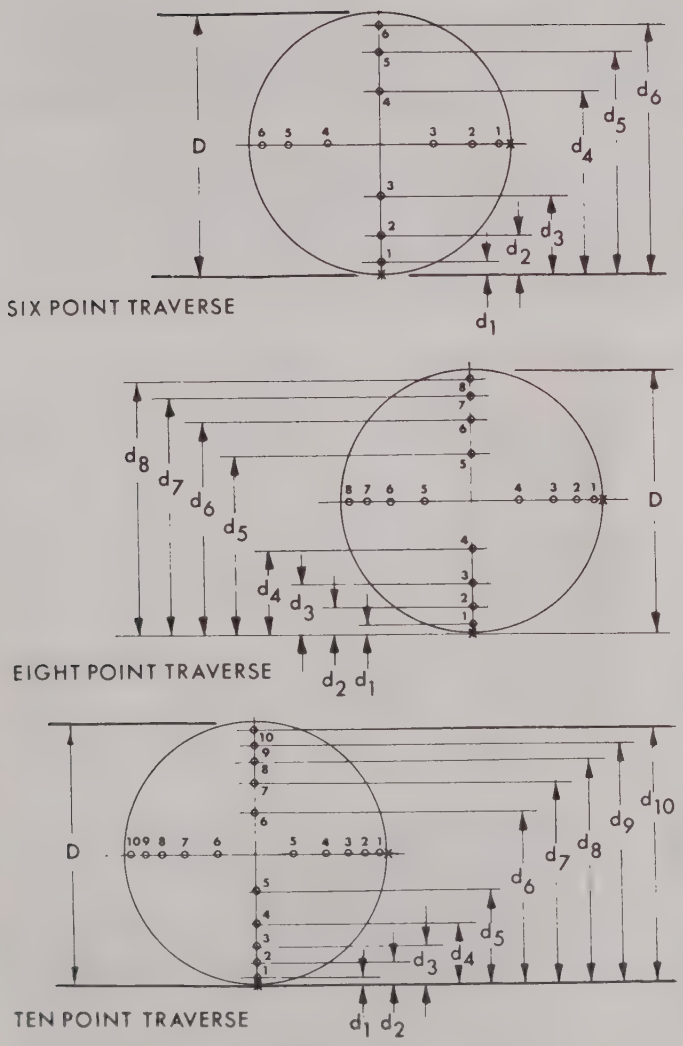


Figure 8. 6-, 8- and 10- Point Traverse Method

For rectangular ducts, mentally divide the duct into at least nine equal areas (preferably more) that are approximately square. Take readings at the centers of these areas and determine the average.

In a circular duct it is advisable to use a traversing method whereby the cross sectional area is divided into a number of concentric rings of equal area, as shown in Figure 7. The center distances of the individual areas have been calculated for 6, 8 and 10 point traverses and are tabulated in TABLES 3 through 6.

A traverse should be made across two perpendicular diameters. For the 6, 8 and 10 point traverse method, the distances from the reference point for a variety of duct diameters have been calculated. TABLE 3 shows the distances of the individual measuring points from the reference point expressed in pipe diameters. Tables 4, 5 and 6 show the required probe immersions from the reference point expressed in inches.

AIR VELOCITY AT EXHAUST OPENINGS

Measure exhaust opening at grinding or buffing wheels only when no work is in progress, to avoid contamination of the sensing elements.

CAUTION

THE USER MUST EXERCISE EXTREME CARE TO ENSURE THAT THE PROBE OR THE INSTRUMENT DOES NOT INTERFERE WITH ANY MOVING EQUIPMENT.

When measuring velocity at spray booths, fume hoods or biological cabinets, place probe in the plane defined by the edge of the booth.

Traverse Method ⬇	Table 3. Probe Immersion as a Function of Duct Diameter									
	d_1	d_2	d_3	d_4	d_5	d_6	d_7	d_8	d_9	d_{10}
6 point	0.043	0.147	0.296	0.704	0.853	0.957	—	—	—	—
8 point	0.032	0.105	0.194	0.323	0.677	0.806	0.895	0.968	—	—
10 point	0.025	0.082	0.146	0.226	0.342	0.658	0.774	0.854	0.918	0.975

Duct Dia. (In.)	Table 4. Probe Immersion for 6 pt. Traverse					
	d_1	d_2	d_3	d_4	d_5	d_6
10	3/8	1-1/2	3	7	8-1/2	9-5/8
12	1/2	1-3/4	3-1/2	8-1/2	10-1/4	11-1/2
14	5/8	2	4-1/8	9-7/8	12	13-3/8
16	3/4	2-3/8	4-3/4	11-1/4	13-5/8	15-1/4
18	3/4	2-5/8	5-3/8	12-5/8	15-3/8	17-1/4
20	7/8	3	6	14	17	19-1/8
22	1	3-1/4	6-1/2	15-1/2	18-3/4	21
24	1	3-1/2	7-1/8	16-7/8	20-1/2	23

Duct Dia. (In.)	Table 5. Probe Immersion for 8 pt. Traverse							
	d_1	d_2	d_3	d_4	d_5	d_6	d_7	d_8
10	5/16	1	2	3-1/4	6-3/4	8	9	9-5/8
12	3/8	1-1/4	2-3/8	3-7/8	8-1/8	8-3/4	10-3/4	11-1/2
14	7/16	1-1/2	2-3/4	4-1/2	9-1/2	11-1/4	12-1/2	13-1/2
16	1/2	1-5/8	3-1/8	5-1/8	10-7/8	12-7/8	14-3/8	15-1/2
18	9/16	1-7/8	3-1/2	5-7/8	12-1/4	13-1/2	16-1/8	17-1/2
20	5/8	2-1/8	3-7/8	6-1/2	18-1/2	16-1/8	17-7/8	19-3/8
22	11/16	2-3/8	4-1/4	7-1/8	14-7/8	17-3/4	19-3/4	21-1/4
24	3/4	2-1/2	4-5/8	7-3/4	16-1/4	19-1/2	21-1/2	23-1/4

Duct Dia. (In.)	Table 6. Probe Immersion for 10 pt. Traverse									
	d_1	d_2	d_3	d_4	d_5	d_6	d_7	d_8	d_9	d_{10}
10	1/4	7/8	1-1/2	2-1/4	3-3/8	6-5/8	7-3/4	8-1/2	9-1/8	9-3/4
12	1/4	1	1-3/4	4-1/8	4-1/8	7-7/8	9-1/4	10-1/4	11	11-3/4
14	3/8	1-1/8	2	3-1/8	4-3/4	9-1/4	10-7/8	12	12-7/8	13-5/8
16	3/8	1-1/4	2-3/8	3-5/8	5-1/2	10-1/2	12-3/8	13-5/8	14-3/4	15-5/8
18	1/2	1-1/2	2-5/8	4-1/8	6-1/8	11-7/8	13-7/8	15-3/8	16-1/2	17-1/2
20	1/2	1-5/8	2-7/8	4-1/2	6-7/8	13-1/8	15-1/2	17-1/8	18-3/8	19-1/2
22	1/2	1-3/4	3-1/4	5	7-1/2	14-1/2	17	18-3/4	20-1/4	21-1/2
24	5/8	2	3-1/2	5-3/8	8-1/4	15-3/4	18-5/8	20-1/2	22	23-3/8

WARRANTY / REPAIR INFORMATION

Contact Alnor Instrument Company before returning your Alnor Instrument to the factory. See INSTRUCTIONS FOR RETURN. Follow the procedure carefully as it will expedite processing. Failure to follow the procedure will/may cause return of unit unrepaired. Send your instrument to the factory transportation prepaid. To assure fast turn-around time, fill out this form with as much detail as possible and attach it to the instrument.

Instrument Model _____

Serial Number _____

Date of Purchase_____Where Purchased_____

Describe Malfunction _____

_____

_____

_____

Describe Environment _____

_____

_____

_____

Return Instrument To:

Name _____
(Your name or company)

Address _____

_____

Telephone_____

Address Correspondence To:

Name _____
(Your name or company)

Address _____

_____

Telephone_____

INSTRUCTIONS FOR RETURN

Damaged in Transit

All shipments are carefully examined by Alnor Quality Assurance and carefully packed for shipment. They are insured in the customer's name with the carrier. On receipt, if the shipping container appears to have been damaged during shipment, the instrument should be thoroughly inspected. The delivering carrier's papers should be signed noting the apparent damage.

If the instrument itself has been damaged, a claim should be promptly filed against the carrier by the customer. Alnor will assist the customer by supplying all pertinent shipping information; however, the claim must be filed by the insured.

If the instrument is damaged beyond use, a new order should be placed with Alnor while awaiting reimbursement from the carrier for the damaged instrument.

Malfunction

Please follow these steps should you require factory service or repair of your Alnor Instrument:

1. a. Telephone Alnor Instrument Company Repair Department 312-647-7866 for cost of repair or recalibration, Authorization For Repair (AFR) number and shipping instructions.

   b. If you require recalibration, determine whether you prefer:

      —Certificate of Calibration, no data (states instrument checked and found to be within accuracy claimed and specifications listed in current literature).

      —Certificate of Traceability (to NBS) with data (states instrument compared with factory standard traceable to NBS, lists of calibration data, i.e., "Standards reads. . ." and "This instrument reads. . ."

2. Obtain a Purchase Order or purchase order number from your Purchasing Department showing instrument model number and cost of repair and/or recalibration.
3. Securely package your instrument in a strong container, surrounded by at least two inches of suitable shock-absorbing material. Include the Purchase Order, or Reference the Purchase Order on your packing slip.
4. Mark the outside of the shipping container with the AFR Control number.
5. Forward the instrument prepaid to the following address:

ALNOR INSTRUMENT COMPANY
7555 N. Linder Avenue
Skokie, IL 60077
Attn: Repair Department

*Please note that instruments received improperly marked or without an accompanying Purchase Order may be returned at your expense.

Please also note that AFR# will be cancelled if the instrument is not received by ALNOR within 60 days.

Equipment Log

MODEL _____

DATE OF PURCHASE _____

MAINTENANCE RECORD

1. _____	2. _____	3. _____
4. _____	5. _____	6. _____
7. _____	8. _____	9. _____
10. _____	11. _____	12. _____

CALIBRATION CONSTANTS

S1	S2	OFF3	DATE

NOTES: _____

ALNOR INSTRUMENT COMPANY
7555 N. LINDER AVENUE
SKOKIE, ILLINOIS 60077
~~708 (312) 647-7866~~ # 708-677-3500
TELEX 72-4458
TELEFAX (312) 647-0354

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